Road & Bridge Design Publications

Monthly Update – May 2021

Revisions for the month of **May** are listed and displayed below and will be included in projects submitted for the **September** letting, except as specified below.

E-mail road related questions to MDOT-Road-Design-Standards@michigan.gov.
E-mail bridge related questions to MDOT-Bridge-Design-Standards@michigan.gov.

Special Details

R-112-J: Shoulder and Center Line Corrugations: Eliminated the use of standard corrugations for non-freeway shoulders and added details to replace them (sinusoidal corrugations/mumble strips).

Note: This detail will be effective for the August 2021 letting.

Road Design Manual

6.05.11: Corrugations in Shoulders and Pavement: Updated the section for the use of sinusoidal corrugations.

Note: These changes will be effective for the August 2021 letting.

Bridge Design Manual

7.03.09 B (LFD): Added material requirements for steel H-Piles and metal shell piles for CIP piles.

7.03.09 B.1 (LRFD): Updated metal shell pile sizes and driving resistance. Also added Grade 3 Modified (50 ksi) material option for metal shell piles. This material has a greater availability.

8.03 U: Updated to active voice and added use statement.

8.05 X & Y & 8.07.03 R: Updated to active voice.

8.06.05 D: Updated pile shell size options, corresponding to section 7.03.09 B.

8.07.03 J. & K: Added Prest Conc 1800 Beam pay item to options for payment of threaded reinforcement and lifting devices.

8.07.03 M, N. & O: Added Michigan 1800 beam to use statements for coating of beams and reinforcement grade.

10.01.10: Deleted reference to the Special Provision for culverts. This information has been added to the 2020 Standard Specifications.

Road & Bridge Design Publications

Monthly Update – May 2021

12.08.03 A.2: Updated 2020 Standard Specifications table references for concrete overlay and structure patching mixtures.

Updates to the MDOT Cell Library, Sample Plans, and other automated tools may be required in tandem with some of this month's updates. Until such updates can be made, it is the designer's/detailer's responsibility to manually incorporate any necessary revisions to notes and plan details to reflect these revisions.

Index to Special Details

5-24-2021

⑥

SPECIAL DETAIL NUMBER	NUMBER OF SHEETS	TITLE	CURRENT DATE
21	2	GUARDRAIL AT INTERSECTIONS	4-9-18
24	8	GUARDRAIL ANCHORED IN BACKSLOPE TYPES 4B, 4T, & 4MGS-8	9-28-18
99	2	CHAIN LINK FENCE WITH WIRE ROPE	9-22-14
R-15-G	3	COVER K	7-26-19
R-27-F	1	BRIDGE APPROACH CURB & GUTTER (USING EXISTING CATCH BASIN)	10-14-19
R-28-J	7	CURB RAMP AND DETECTABLE WARNING DETAILS	5-8-20
R-32-F	8	APPROACH CURB & GUTTER DOWNSPOUTS	10-7-20
R-32-SD	6	APPROACH CURB & GUTTER DOWNSPOUTS (FOR EXISTING RAILINGS)	11-14-19
R-33-G	2	CONCRETE VALLEY GUTTER AND URBAN FREEWAY CURB	8-14-19
R-53-A	22	TEMPORARY CONCRETE BARRIER LIMITED DEFLECTION	8-14-15
R-56-F	6	GUARDRAIL MEDIAN OBJECT PROTECTION	2-5-19
R-60-J	17	GUARDRAIL TYPES A, B, BD, T, TD, MGS-8, & MGS-8D	8-6-20
R-62-H	4	GUARDRAIL APPROACH TERMINAL TYPE 2M	9-22-20
R-63-C	16	GUARDRAIL APPROACH TERMINAL TYPES 3B & 3T	2-5-19
R-66-E	4	GUARDRAIL DEPARTING TERMINAL TYPES B, T, & MGS	9-28-18
R-67-G	16	GUARDRAIL ANCHORAGE, BRIDGE, DETAILS	08-13-20
R-67-SD	7	GUARDRAIL ANCHORAGE, BRIDGE, DETAILS (FOR EXISTING RAILINGS)	11-13-19
R-72-D	6	GUARDRAIL LONG SPAN INSTALLATIONS	3-4-20
R-73-F	3	GUARDRAIL OVER BOX OR SLAB CULVERTS	8-1-19
R-102-C	1	INSTALLATION OF WOVEN WIRE FENCE	3-22-21
*R-112-J	9	SHOULDER AND CENTER LINE CORRUGATIONS	5-13-21
R-126-I	5	PLACEMENT OF TEMPORARY CONCRETE & STEEL BARRIER	8-25-15

*** Denotes New or Revised Special Detail to be included in projects for (beginning with) the August letting.**

Notes:

Former Standard Plans IV-87, IV-89, IV-90, and IV-91 Series, used for building cast-in-place concrete head walls for elliptical and circular pipe culverts, are now being replaced with plans that detail each specific size. The Bureau of Bridges & Structures, Structure Design Section, Special Structures Unit will provide special details for inclusion in construction plans for MDOT jobs. To assure prompt delivery, requests ***must*** **be made in advance.** Contact: MDOT-TriezenbergSquad@michigan.gov

Former Standard Plans IV-93 and IV-94 series have been replaced with precast concrete box & three-sided culverts as per the 2020 Standard Specifications for Construction.

Index to Bridge Detail Sheets

5-24-2021

⑦

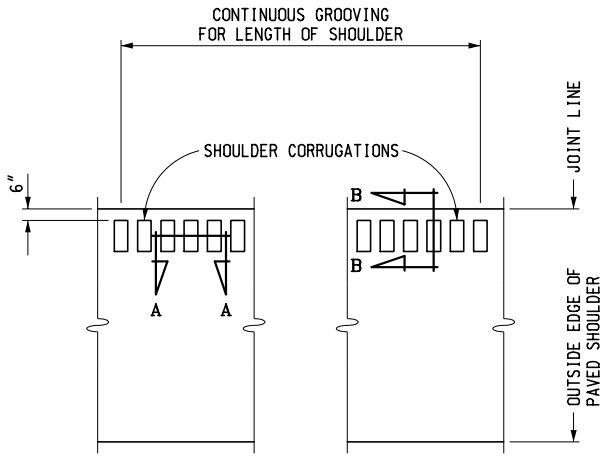
DETAIL NUMBER	NUMBER OF SHEETS	TITLE	CURRENT DATE
B-22-E	5	BRIDGE RAILING, THRIE BEAM RETROFIT (R4 TYPE RAILING)	10-23-19
B-23-F	6	BRIDGE RAILING, THRIE BEAM RETROFIT (OPEN PARAPET RAILING)	10-23-19
B-28-A	7	BRIDGE BARRIER RAILING, TYPE 7	8-24-20
B-29-A	8	BRIDGE BARRIER RAILING, TYPE 6	8-24-20
B-50-A	3	BRIDGE RAILING, CONCRETE BLOCK RETROFIT	10-15-19
B-101-G	2	DRAIN CASTING ASSEMBLEY DETAILS	7-26-18
EJ3AD	1 to 3	EXPANSION JOINT DETAILS (See Notes)	4-26-21
EJ4Q	1 to 3	EXPANSION JOINT DETAILS (See Notes)	4-26-21
PC-1M	1	PRESTRESSED CONCRETE I-BEAM DETAILS (See Notes)	8-23-17
PC-2H	1	70" PRESTRESSED CONCRETE I-BEAM DETAILS (See Notes)	8-23-17
PC-4F	1	PRESTRESSED CONCRETE 1800 BEAM DETAILS (See Notes)	8-23-17

*** Denotes New or Revised Special Detail to be included in projects for (beginning with) the September letting.**

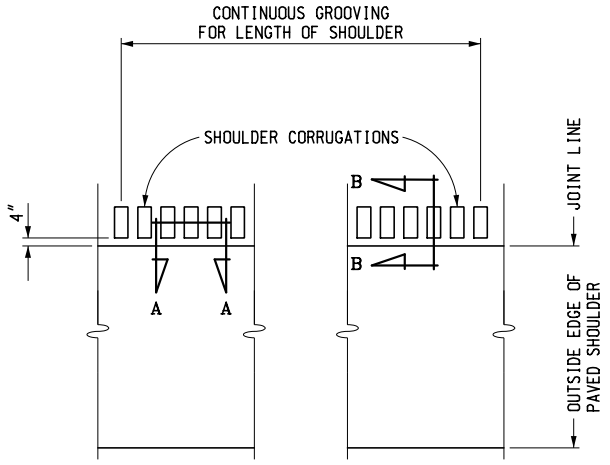
Notes:

Details EJ3AD & EJ4Q are interactive, i.e., designers and detailers choose details based upon railing type and angle of crossing and fill in the project specific dimensions for the end plate. Place all details appropriate for the project (including the end plate), structure specific information, and the Expansion Joint Device quantity on the sheet. Add the sheet to the plans as a normal plan sheet. Call out and designate the location of the expansion joint device and the end plate on the Superstructure Sheet in the plan set.

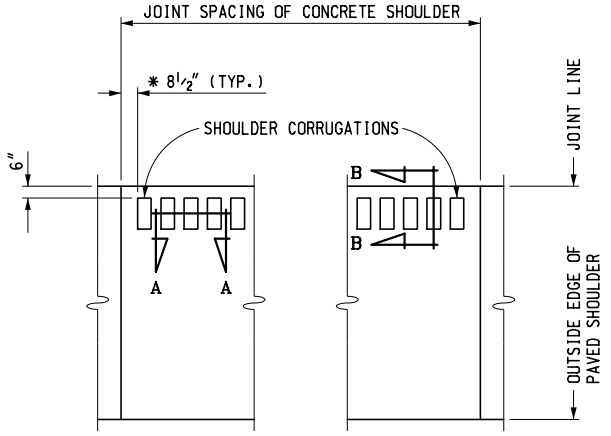
Details PC-1M, PC-2H, and PC-4F shall have structure specific information and quantities added to the sheet. The sheet shall then be added to the plans as a normal plan sheet.



HMA SHOULDER PLAN
ADJACENT TO 12' LANE

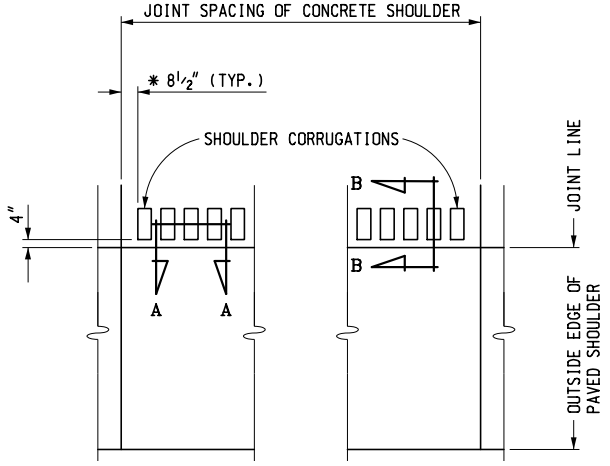


HMA SHOULDER PLAN
ADJACENT TO 14' LANE



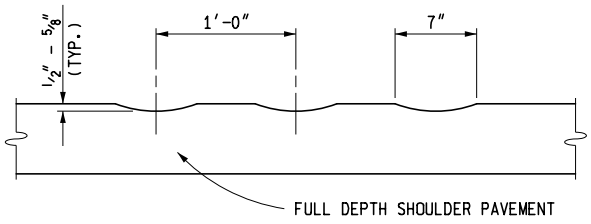
CONCRETE SHOULDER PLAN
ADJACENT TO 12' LANE

* THE DISTANCE FROM THE CORRUGATION TO THE TRANSVERSE JOINT SHALL BE AT LEAST 6" BUT LESS THAN 12".

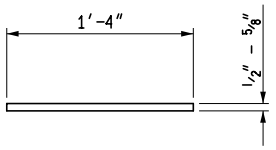


CONCRETE SHOULDER PLAN
ADJACENT TO 14' LANE

* THE DISTANCE FROM THE CORRUGATION TO THE TRANSVERSE JOINT SHALL BE AT LEAST 6" BUT LESS THAN 12".



SECTION A - A



SECTION B - B

FREEWAY SHOULDER CORRUGATIONS

(FOR FREEWAY SHOULDERS PAVED 4 FEET OR GREATER)

MDOT Michigan Department of Transportation

PREPARED BY DESIGN DIVISION

DRAWN BY: B.L.T.

CHECKED BY: W.K.P.

DEPARTMENT DIRECTOR
Paul C. Ajegba

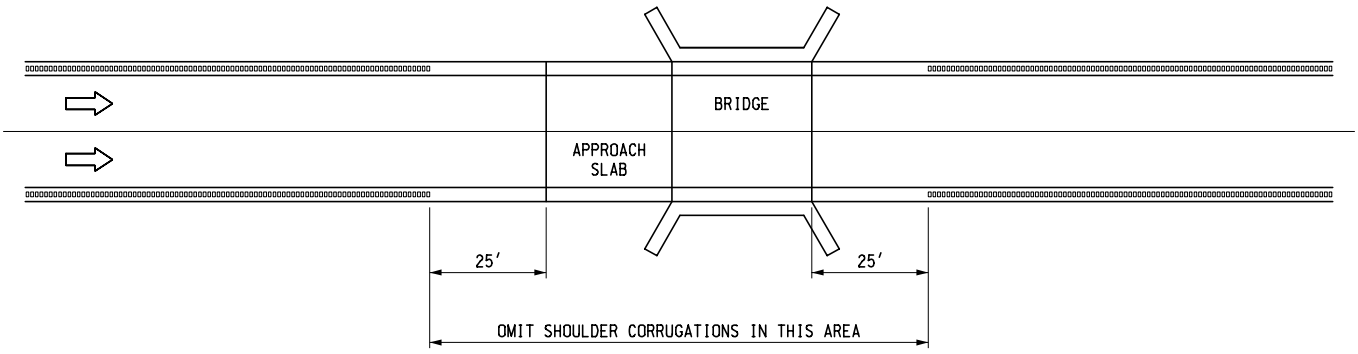
APPROVED BY: _____
DIRECTOR, BUREAU OF FIELD SERVICES

APPROVED BY: _____
DIRECTOR, BUREAU OF DEVELOPMENT

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

SHOULDER AND CENTER LINE CORRUGATIONS

F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 1 OF 9



SHOULDER CORRUGATIONS AT BRIDGES

FREEWAY SHOULDER CORRUGATIONS

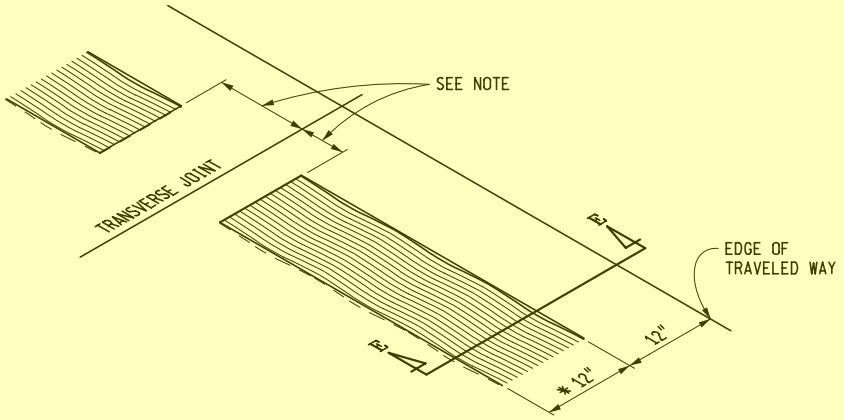
(FOR FREEWAY SHOULDERS PAVED 4 FEET OR GREATER)

MICHIGAN DEPARTMENT OF TRANSPORTATION

BUREAU OF DEVELOPMENT STANDARD PLAN FOR

SHOULDER AND CENTER LINE CORRUGATIONS

F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 2 OF 9

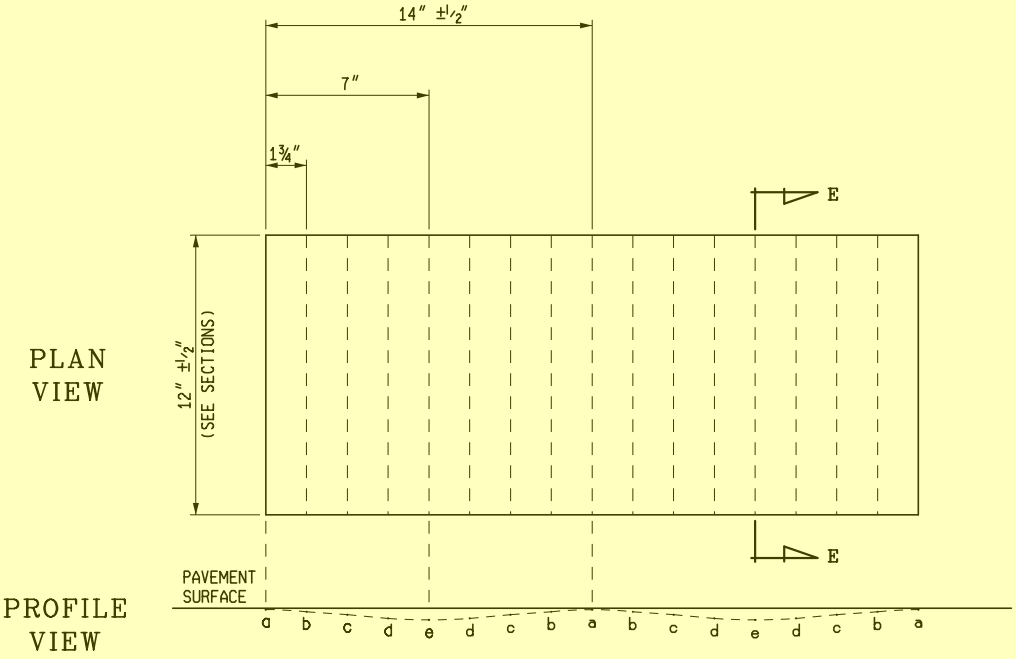


TYPICAL NON-FREEWAY
SHOULDER CORRUGATION INSTALLATION

* LATERAL DEVIATION SHALL NOT EXCEED 1" IN 100'.

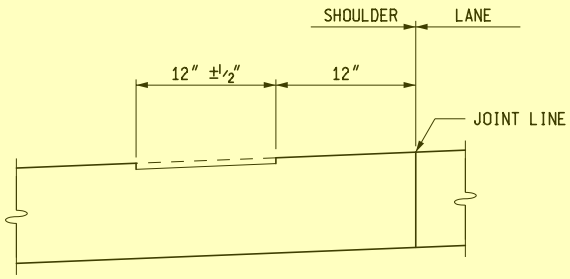
NOTE:

ON CONCRETE PAVEMENTS, THE DISTANCE FROM A SHOULDER CORRUGATION TO A TRANSVERSE JOINT SHALL BE AT LEAST 6" BUT LESS THAN 12".



	DEPTH AT EDGE	
LOCATION	MILS	INCHES *
a	62.5	1/16
b	156	5/32
c	281	9/32
d	438	7/16
e	500	1/2

* +1/8"



SECTION E-E

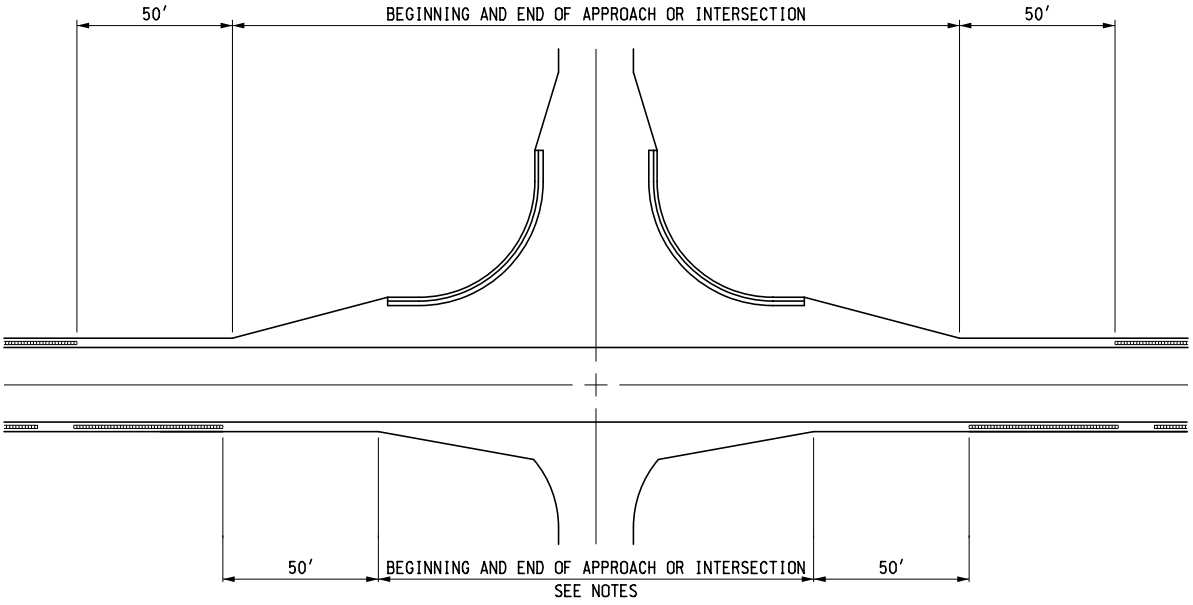
CONCRETE & HMA
SHOULDER

SINUSOIDAL CORRUGATIONS

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

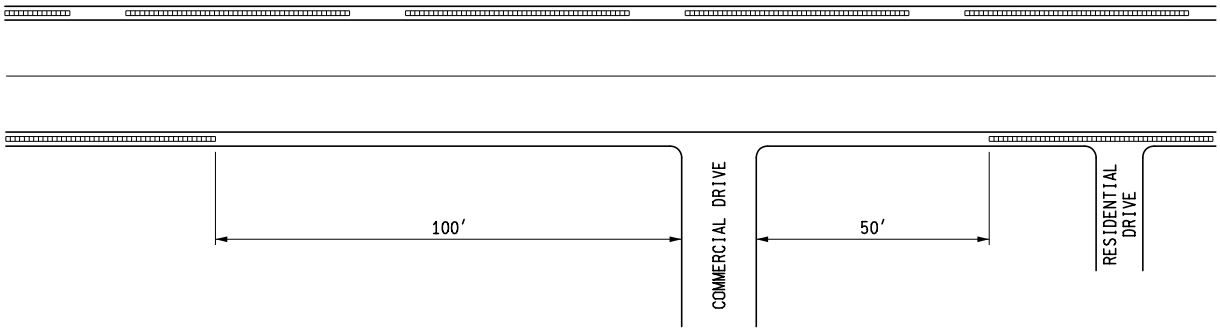
SHOULDER AND CENTER LINE CORRUGATIONS

F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 3 OF 9

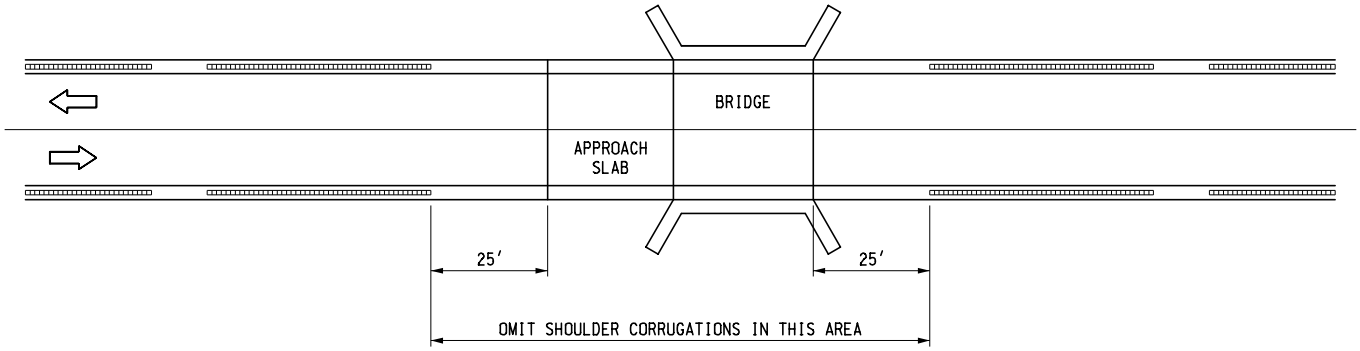


NOTE:

SHOULDER CORRUGATIONS MAY BE OMITTED IN AREAS WITH HIGH CONCENTRATIONS OF DRIVES, WHEN DIRECTED BY THE ENGINEER.



SHOULDER CORRUGATIONS AT INTERSECTIONS



SHOULDER CORRUGATIONS AT BRIDGES

NON-FREEWAY SHOULDER CORRUGATIONS

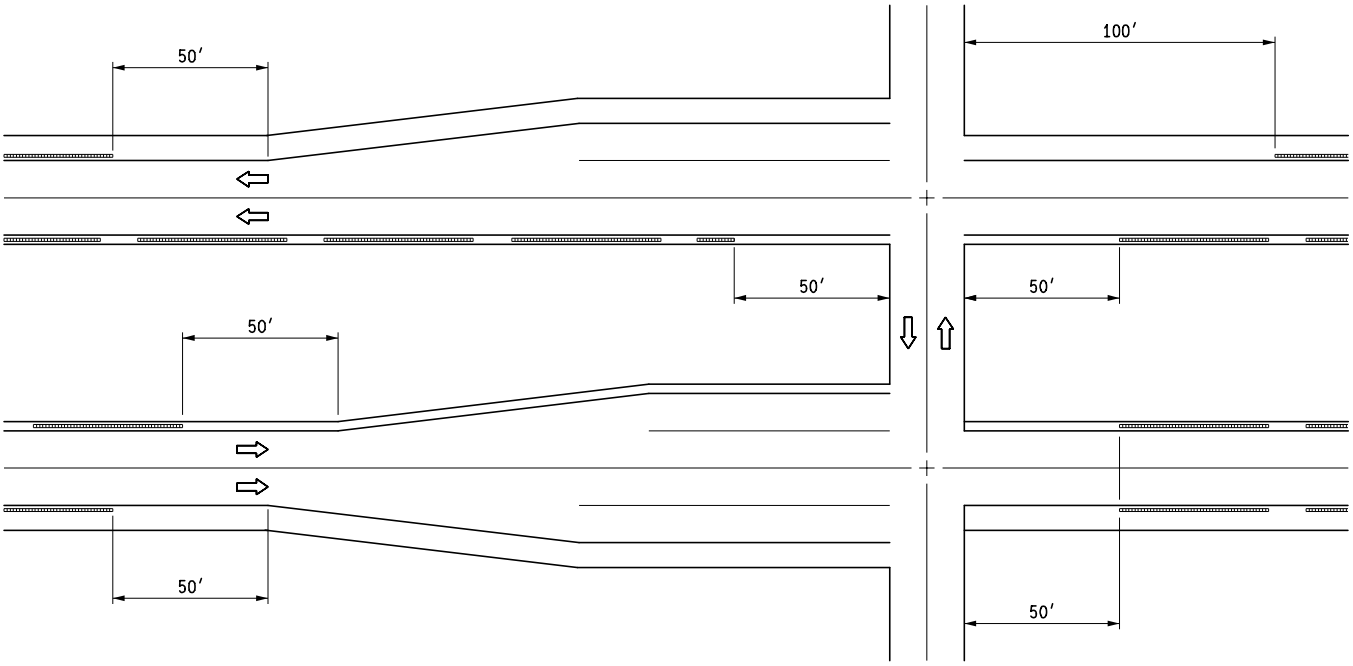
(FOR NON-FREEWAY SHOULDERS PAVED 6 FEET OR GREATER)

MICHIGAN DEPARTMENT OF TRANSPORTATION

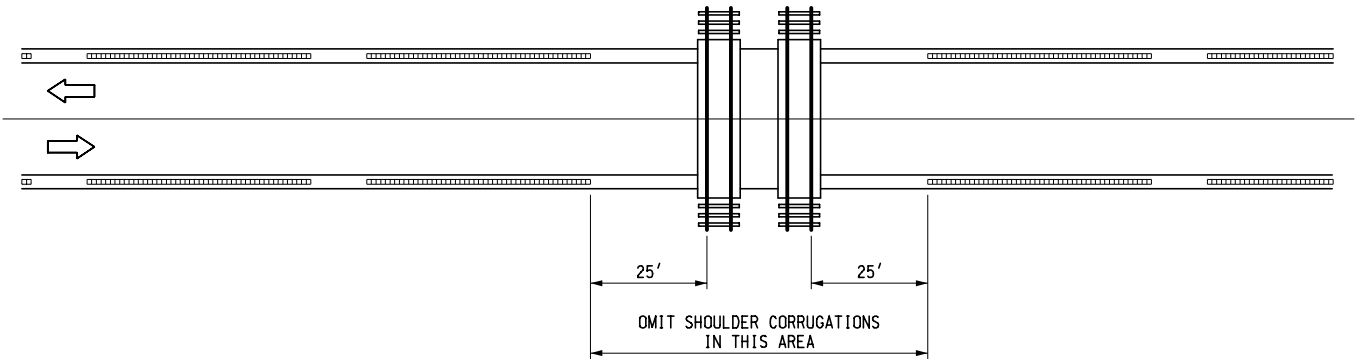
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

SHOULDER AND CENTER LINE CORRUGATIONS

F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 4 OF 9



SHOULDER CORRUGATIONS AT INTERSECTIONS



SHOULDER CORRUGATIONS AT RAILROADS

NON-FREEWAY SHOULDER CORRUGATIONS

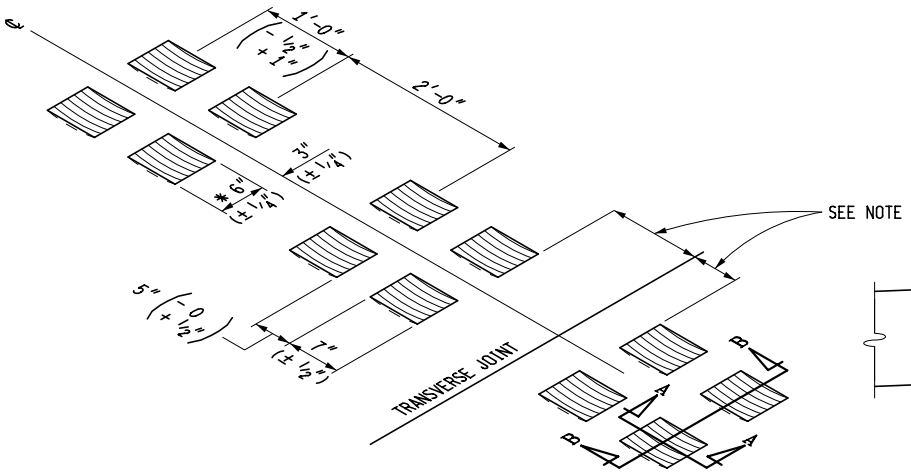
(FOR NON-FREEWAY SHOULDERS PAVED 6 FEET OR GREATER)

MICHIGAN DEPARTMENT OF TRANSPORTATION

BUREAU OF DEVELOPMENT STANDARD PLAN FOR

SHOULDER AND CENTER LINE CORRUGATIONS

F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 5 OF 9



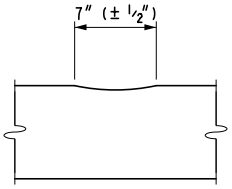
TYPICAL NON-FREEWAY CENTER LINE
CORRUGATION INSTALLATION
FOR CONCRETE PAVEMENT

* LATERAL DEVIATION SHALL NOT EXCEED 1" IN 100'.

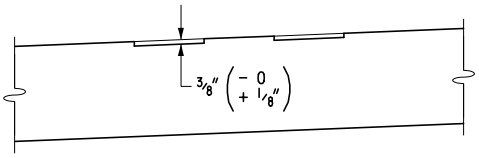
NOTES:

ON CONCRETE PAVEMENTS, THE DISTANCE FROM A CENTER LINE CORRUGATION TO A TRANSVERSE JOINT SHALL BE AT LEAST 6" BUT LESS THAN 12".

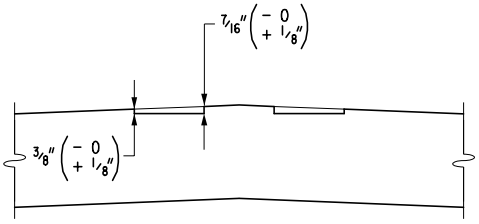
ON CONCRETE PAVEMENTS, CORRUGATIONS MAY BE CONSTRUCTED IN TWO PASSES AND THEREFORE NOT BE SYMMETRICAL ACROSS THE CENTER LINE.



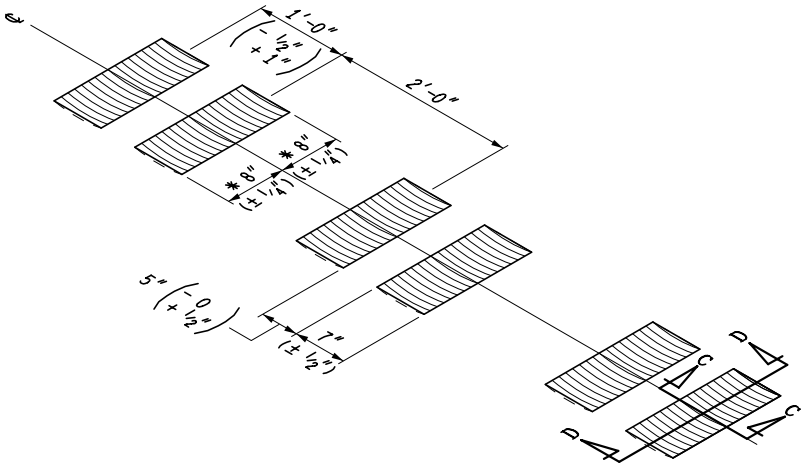
SECTION A-A



SECTION B-B
SUPERELEVATED ROADWAY

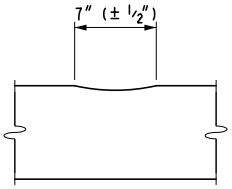


SECTION B-B
CROWNED ROADWAY

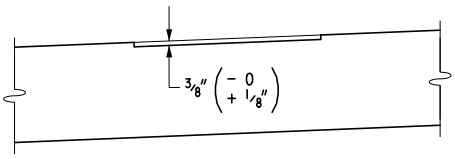


TYPICAL NON-FREEWAY CENTER LINE
CORRUGATION INSTALLATION
FOR HMA PAVEMENT

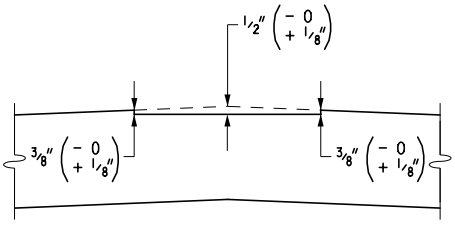
* LATERAL DEVIATION SHALL NOT EXCEED 1" IN 100'.



SECTION C-C



SECTION D-D
SUPERELEVATED ROADWAY



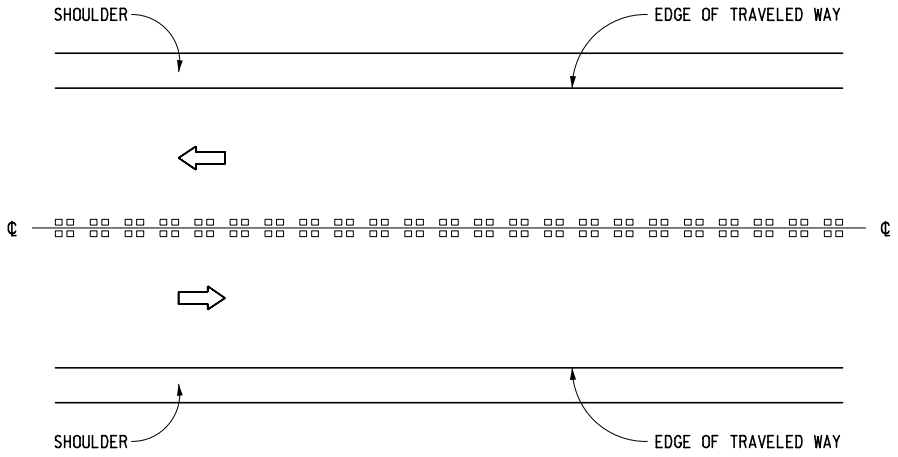
SECTION D-D
CROWNED ROADWAY

NON-FREEWAY CENTER LINE CORRUGATIONS

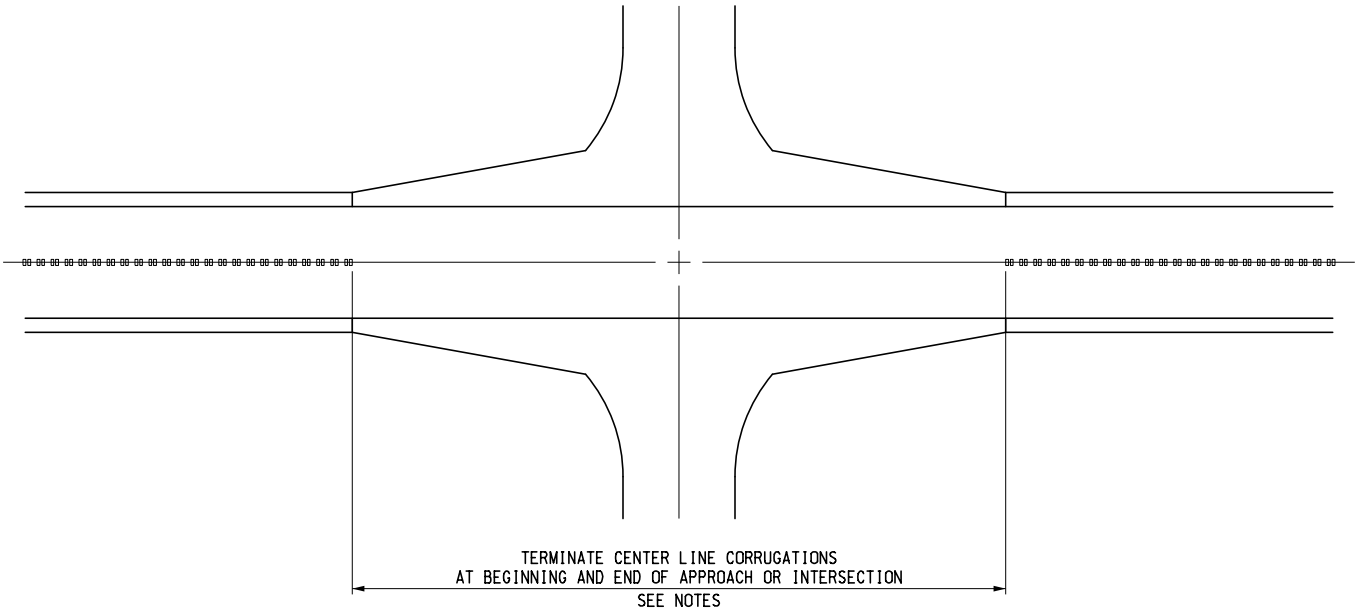
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

SHOULDER AND CENTER LINE CORRUGATIONS

F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 6 OF 9



CENTER LINE CORRUGATIONS ON TWO-WAY ROADWAYS



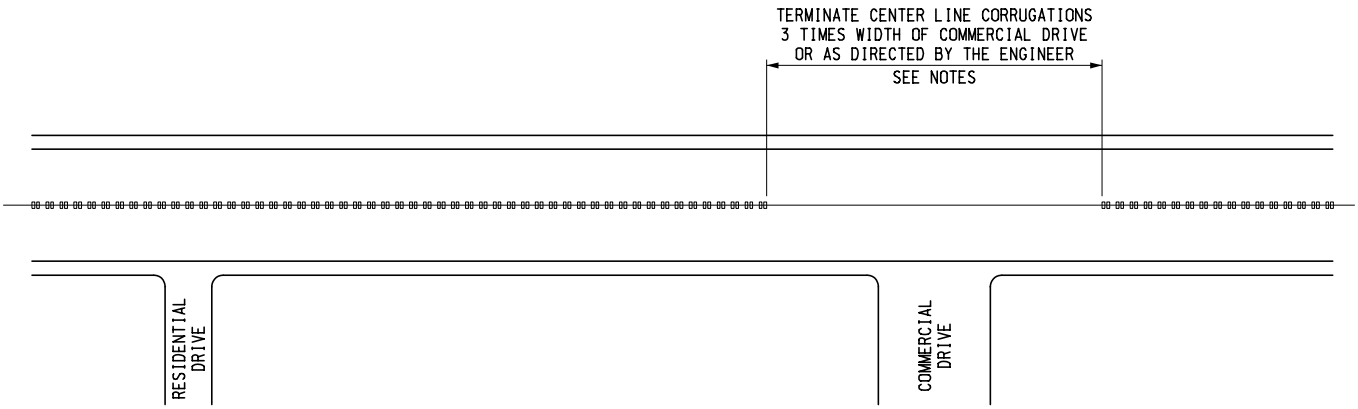
CENTER LINE CORRUGATIONS AT INTERSECTIONS

NON-FREEWAY CENTER LINE CORRUGATIONS

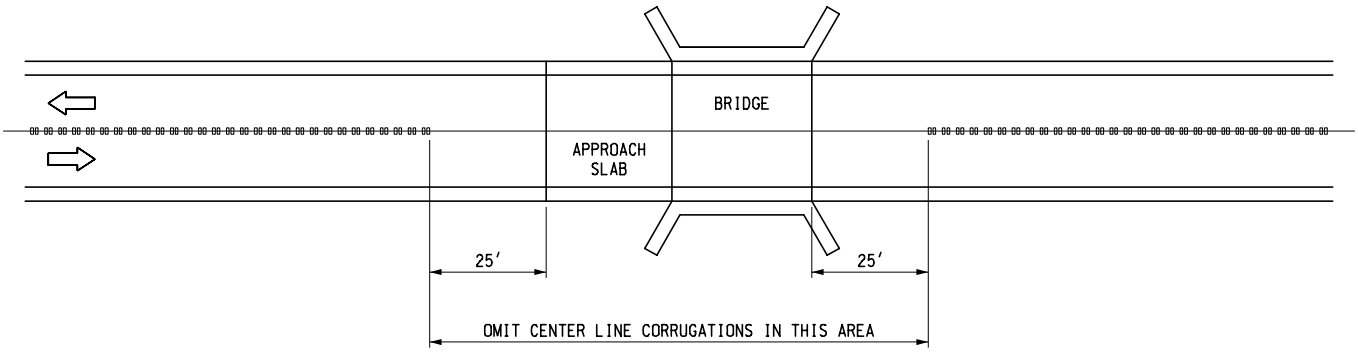
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

SHOULDER AND CENTER LINE CORRUGATIONS

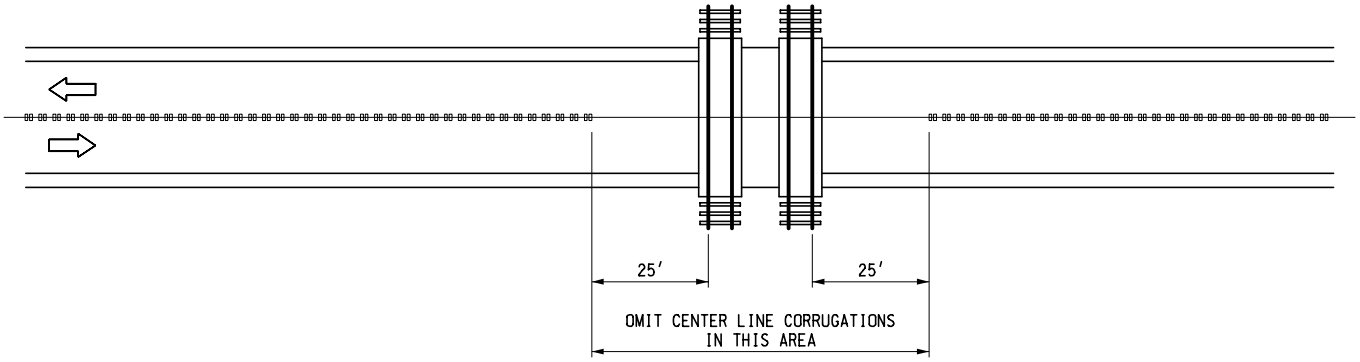
F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 7 OF 9



CENTER LINE CORRUGATIONS AT DRIVEWAYS



CENTER LINE CORRUGATIONS AT BRIDGES



CENTER LINE CORRUGATIONS AT RAILROADS

NON-FREEWAY CENTER LINE CORRUGATIONS

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT STANDARD PLAN FOR

SHOULDER AND CENTER LINE CORRUGATIONS

F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 8 OF 9

NOTES: (NON-FREEWAY)

SHOULDER CORRUGATION CROSS-SECTIONS AND LOCATIONS SHALL BE AS DETAILED ON THIS STANDARD. CORRUGATIONS ON NON-FREEWAYS SHALL BE IN CONCRETE AND HMA SHOULDERS PAVED AT LEAST 6′-0″ WIDE WITH A POSTED SPEED OF 55 MPH. CORRUGATIONS CAN BE USED IN OTHER SITUATIONS WHERE THEY HAVE BEEN PREVIOUSLY APPROVED USING CURRENT GUIDELINES.

CORRUGATIONS SHALL NOT BE PLACED OVER A TRANSVERSE SHOULDER JOINT.

DO NOT MILL SHOULDER OR CENTER LINE CORRUGATIONS THROUGH ANY INTERSECTION, MARKED CROSSWALK, NON-MOTORIZED PATH CROSSING, OR SNOWMOBILE CROSSING.

NOTES: (FREEWAY)

SHOULDER CORRUGATION CROSS-SECTIONS AND LOCATIONS SHALL BE AS DETAILED ON THIS STANDARD. CORRUGATIONS ON FREEWAYS SHALL BE IN CONCRETE AND HMA SHOULDERS PAVED 4′-0″ OR WIDER OR WHERE THE SHOULDER LIES BETWEEN THE PAVEMENT AND VALLEY GUTTER OR CURB AND GUTTER. CORRUGATIONS WILL NOT BE USED IN FREEWAY EXIT/ENTRANCE RAMP SHOULDERS OR WHERE SHOULDERS ARE SEPARATED FROM THE PAVEMENT BY VALLEY GUTTER OR CURB AND GUTTER. EXCEPT FOR LOOP RAMPS, CORRUGATIONS WILL BE USED ON FREEWAY TO FREEWAY RAMPS.

CORRUGATIONS SHALL NOT BE PLACED OVER A TRANSVERSE SHOULDER JOINT.

CORRUGATION LOCATION IN THE AREA OF FREEWAY RAMPS WILL BE AS FOLLOWS: THE TYPICAL OFFSET WILL BE INCREASED TO 24″ AND BE LOCATED ON THE SHOULDER SIDE OF THE JOINT BEGINNING 300′ IN ADVANCE OF THE EXIT RAMP TAPER. THIS OFFSET WILL CONTINUE UNTIL THE 2′ POINT OF THE GORE. FOR EXIT/ENTRANCE RAMPS AND LOOPS RAMPS THE CORRUGATIONS WILL END ALONG THE RAMP AT THIS POINT AND SIMULTANEOUSLY RESUME ON THE MAINLINE SHOULDER WITH THE NORMAL OFFSET. THE CONFIGURATION FOR ENTRANCE RAMPS WILL BE IN THE REVERSE ORDER OF THE EXIT RAMPS. FOR FREEWAY TO FREEWAY RAMPS, IN addition TO RESUMING THE MAINLINE SHOULDER CORRUGATION AT THIS POINT, RETURN TO THE NORMAL MAINLINE OFFSET ALONG THE LENGTH OF THE RAMP SHOULDER.

WITHIN AN URBAN FREEWAY AREA OR OTHER LIMITED FREEWAY AREA, SHOULDER CORRUGATIONS MAY BE OFFSET UP TO 12″ FROM THE EDGE OF THE TRAVEL LANE, AS SHOWN IN THE PLANS, OR AS DIRECTED BY THE ENGINEER. IF NEEDED, THE CORRUGATION MAY BE LOCATED ON THE OPPOSITE SIDE OF THE JOINT FOR 14′ LANES TO MAINTAIN THE MINIMUM OFFSET TO THE JOINT LINE.

MICHIGAN DEPARTMENT OF TRANSPORTATION

BUREAU OF DEVELOPMENT STANDARD PLAN FOR

SHOULDER AND CENTER LINE CORRUGATIONS

F.H.W.A. APPROVAL	5-13-2021 PLAN DATE	R-112-J	SHEET 9 OF 9

6.05.11 (revised 5-24-2021)

Corrugations in Shoulders and Pavement

Corrugations (also known as rumble strips) provide a visual and audible warning to a driver that their vehicle is either straying off the road or is encroaching an oncoming lane of traffic. Shoulder corrugations also discourage the unauthorized use of the shoulder as a driving lane.

Corrugations are milled into both concrete and HMA pavements. They cannot be formed in. There are two different types of corrugations in use in Michigan; the first being the individual depressions that have been used for decades (herein referred to as "traditional corrugations"), and a relatively new sine wave pattern (herein referred to as "sinusoidal corrugations", and also known as "mumble strips"). Corrugation cross sections and locations shall be as detailed on standard plan R-112-Series.

Freeway shoulder corrugations should be used in both median and outside shoulders having paved widths of at least 4'. Corrugations are to be included on freeway-to-freeway ramps with the exception of loop ramps, but are otherwise not to be used on freeway exit/entrance ramp shoulders. Corrugations are also omitted where the shoulder is separated from the traveled lanes by a curb and gutter or valley gutter. Freeway shoulder corrugations should be traditional corrugations. Sinusoidal corrugations may be substituted for the traditional corrugations upon evaluation of adjacent land use and discussion with the Pavement Marking Unit.

Existing concrete shoulders might contain intermittent (formed) corrugations that conflict with the proposed placement of retrofit milled corrugations, It should be noted and detailed in the plans that the existing intermittent corrugations should be gapped out rather than milled through.

6.05.11 (continued)

Non-freeway shoulder corrugations should be used on all rural, 2-lane, 4-lane, and divided trunk line roadways where the posted speed is 55 mph and the paved shoulder is at least 6' wide. Non-freeway shoulder corrugations shall be sinusoidal corrugations.

Centerline corrugations should be used on all rural 2-lane and 4-lane trunk line roadways (in both passing and non-passing zones) where the posted speed is 55 mph and the lane plus paved shoulder width beyond the centerline corrugation is greater than 13' in width. Centerline corrugations should be traditional corrugations. Sinusoidal corrugations may be substituted for the traditional corrugations where there is either a history of noise complaints from previously installed traditional centerline corrugations or a high anticipated volume of passing maneuvers near residences, and after also consulting Maintenance to discuss the impacts to winter and pavement maintenance practices.

If safety concerns outweigh other issues such as noise and bicycle use, non-freeway shoulder and centerline corrugations can be considered for use on roadways that do not meet the criteria given above. The Region or TSC should contact the MDOT non-motorized coordinator and non-motorized program staff when considering placing corrugations on shoulders paved less than 6' wide. When placing non-freeway sinusoidal shoulder corrugations, several modifications to the standard placement shown in standard plan R-112-Series may be applied, and when used must be detailed in the plans. Where the paved shoulder is 3' or less or where the paved shoulder is less than 6' and has bicycle traffic, the offset may be reduced to 0" from the standard 12". Where the lane width is 11' or less and the paved shoulder is 3' or less, the width of the sinusoidal corrugation may be reduced to 8" from the standard 12". Where the lane width is greater than 11' and all available paved shoulder must be maintained due to bicycle traffic or otherwise, the sinusoidal corrugation may be placed as an 8" edgeline corrugation.

6.05.11 (continued)

Corrugations in Shoulders and Pavement

In locations where horse-drawn buggies utilize the roadway, do not use shoulder corrugations unless a crash history exists. Document this as a context sensitive design decision. When a correctable crash history does exist, consider using corrugations and widening the shoulder 2' to accommodate both. Document the decision.

In developed rural areas where driveway density exceeds 30 access points within ½ mile, non-freeway shoulder, edgeline and centerline corrugations may be omitted unless a crash history exists. Document the decision.

7.03.09 (continued)

Piles

A. General

8. Pile Batter

   Generally, piles are to be battered no flatter than 3V:1H. Where soil conditions are not good enough to provide sufficient lateral pile resistance, we may increase the angle of batter to 2.5V:1H or even 2V:1H. This measure, however, should be a last resort since it is difficult to maintain driving accuracy when the batter is flatter than 3V:1H.

   If a 2.5V:1H or 2V:1H batter is shown on the plans, note 8.06.05 G must be added to the plans.

9. Cast-in-Place Concrete Pile Shells

   The minimum pile shell thickness shall be 0.312". (8-20-2012)

10. Pile Numbering

    A pile numbering scheme shall be shown on the plans for those units having piles. Each pile shall be assigned a number in a particular row or on an individual basis.

11. Pile Driving Vibration Evaluation (11-28-2011)

    Driven piles located within a distance of 100 ft of historic or vibration sensitive structures shall be evaluated for damage potential from vibration and/or vibration induced settlement.

    Driven piles shall not be located within a 25 ft radius of existing spread footings, critical utilities, or in-service pavements without mitigation and/or vibration and settlement monitoring specifications.

12. Loads Applied to Piles

    Piles are to be designed for compression, shear, and/or moment loads only. Piles are not to be designed for tension loads unless approved by the MDOT Geotechnical Services Section. (10-28-2019)

7.03.09 (continued)

B. Pile Capacity

In general, the specified capacity shown on the plans and used in the substructure design should be 60 tons. In some cases, the soil profile will indicate that a higher or lower specified capacity would be more economical. The recommendation from the Geotechnical Services Section will indicate what pile capacity to use. (2-26-2018)

1. Steel H Piles

   The maximum design load on steel H piles shall not exceed the following:

HP 8x36	45 tons
HP 10x42	55 tons
HP 12x53	70 tons
HP 14x73	95 tons

2. Cast-in-Place Concrete Piles

   The maximum design load on cast-in-place concrete piles shall not exceed the following:

10¾" O.D.	45 tons
12" O.D.	65 tons
12¾" O.D.	75 tons
14" O.D.	90 tons

Use steel H-Piles meeting the requirements of AASHTO M270 Grade 50. Use metal shell piles for CIP piles meeting the requirements of ASTM A252 Grade 3 (45 ksi) or Grade 3 Modified (50 ksi). (5-24-2021)

7.03.09 (continued)

Piles

B. Nominal Pile Resistance (R_n)
(8-20-2009)

Design substructures with an initial nominal pile resistance of 350 kips. In some cases, the soil profile will indicate that a higher or lower nominal pile resistance would be more economical. The recommendation from the Geotechnical Services Section will indicate what nominal pile resistance to use.
(11-28-2011) (2-26-2018)

1. Pile Designation/Maximum Nominal Pile Driving Resistance (R_{ndr})

   a. Steel H Piles (11-28-2011)

Pile	**(R_{ndr})**
HP 10X42	275 kips
HP 10X57	350 kips
HP 12X53	350 kips
HP 12X74	500 kips
HP 12X84	600 kips
HP 14X73	500 kips
HP 14X89	600 kips

   b. Metal Shell Piles
   (5-24-2021)

Pile	**(R_{ndr})**
Metal Shell 12" O.D. w/0.312" Walls	250 kips
Metal Shell 14" O.D. w/0.312" Walls	350 kips
Metal Shell 16" O.D. w/0.375" Walls	400 kips
Metal Shell 16" O.D. w/0.500" Walls	500 kips

   c. Timber Piles

Pile	**(R_{ndr})**
Timber Pile	150 kips

7.03.09 B. (continued)

A wave equation analysis, which uses typical pile types and driving equipment known to be locally available, shall be performed by the Geotechnical Engineer to verify drivability. (11-28-2011)

Use steel H-Piles meeting the requirements of AASHTO M270 Grade 50. Use metal shell piles for CIP piles meeting the requirements of ASTM A252 Grade 3 (45 ksi) or Grade 3 Modified (50 ksi).
(5-24-2021)

2. In general, the Resistance Factor for Driven Piles (φ_{dyn}) = 0.50 assuming that the Nominal Pile Driving Resistance (R_{ndr}) is verified using the FHWA-modified Gates Dynamic Formula. The Resistance Factor (φ_{dyn}) = 0.65 when dynamic testing with signal matching (P.D.A. testing) is used and (φ_{dyn}) = 0.80 with static load tests. (See AASHTO LRFD Table 10.5.5.2.3-1 Resistance Factors for Driven Piles)
(11-28-2011) (11-23-2015)

3. In general, Resistance Factor (φ_{dyn}) times the Nominal Pile Resistance (R_n) = Factored Nominal Resistance (R_R).

   (φ_{dyn}) x (R_n) = (R_R)

   The above equation does not hold true in the case of possible downdrag, and/or scour.

4. The nominal pile resistance to be shown on the plans should be equal to the actual demand, based on the final pile layout, divided by the appropriate Resistance Factor for Driven Piles (φ_{dyn}), rounded up to the nearest 10 kips. Do not simply use the Maximum Nominal Pile Driving Resistance (R_{ndr}) for the pile type.
(2-26-2018)

8.03 (continued)

GENERAL PLAN OF SITE SHEET

O. The train movement and speed information shown in the proposal does not represent a commitment by the _____ railroad and is subject to change without notice.

P. Excavate crosshatched area to El ____. [Place this note in the vicinity to which it applies.]

Q. Fill hatched area to El ____ with material from channel excavation. [Place this note in the vicinity to which it applies.]

R. Water level is subject to change. Make a determination of water levels that may exist during construction. [Use on all projects over water where the water level may impact the project work.]

S. Remove _____ cubic yards of topsoil (and unsuitable material) and place ____ cubic yards of "(Embankment, Structure,) (*Embankment,) CIP". [*Use with pile supported footing.] (12-5-2005)

T. Undercut soil classified as ___ and replace with "Embankment, Structure, CIP" compacted to 100 percent of maximum unit weight. Excavation and backfill quantities are based on an estimated undercut to elevation ____. The Engineer will determine actual limits of excavation at the time of construction. (12-5-2005)

U. Railroad owned items (fittings, ties, rails, etc.) that are salvaged become the property of the railroad.[List specific items, as necessary.] (5-24-2021)

8.03 (continued)

V. Implement measures to prevent debris from falling from the structure. (*If debris falls into the waterway, remove it within 24 hours. Since disturbance of the waterway bottom may be as harmful as the debris itself, the preventive measures must be effective.) Removal of debris is included in related items of work. . [*Use for bridges over waterways.] (4-19-2021)

W. Immediately after the construction of an abutment is completed, place slope protection and seeding or sodding on the adjacent embankment slopes. [Use for bridges over waterways.] (9-1-1988)

X. The haul route shown has been approved by the Michigan Department of Environment, Great Lakes and Energy (MDEGLE). If desired, propose a detailed alternate route for MDOT review and submittal to the appropriate permitting agency. No payment will be made for additional time, project costs and project delays resulting from submittal, approval, and/or denial of an alternate route request. Implementation will be the responsibility of the contractor. [Use for bridges over waterways or wetlands.] (6-24-2019)

Y. Coordinates are not available for this project. [Use when coordinates not available due to lack of survey for project.] (12-5-2005)

8.05 (continued)

GENERAL PLAN OF STRUCTURE SHEET

U. Submit alternate methods of stream diversion to the Engineer for approval. [Use when stream diversion method is detailed on Plan Sheet.] (9-18-1998)

V. Place riprap from El ___ to El ____. [Place this note in the vicinity to which it applies, when lateral limits are not fixed.]

W. False decking includes the area bounded by (Reference Lines ___& __) (edges of shoulders) and outside flange fascias of fascia beams. The estimated area is ____square feet during removal (and ____square feet during proposed construction). [Detail limits on the plans and include areas in note.] (4-19-2021)

X. When casting items into structural precast concrete to facilitate bridge construction (forming, finishing, etc.) use items that are galvanized in accordance with ASTM B633, Service Condition 4 or epoxy coated. Cast inserts with the beams. Do not field install inserts. [Use for box and three-sided culverts, MSE walls, sound walls, precast bridge element systems, etc.](4-19-2021)

Y. Do not use wheeled, roller based or machine mounted compaction equipment to compact the subgrade, subbase, and base within 10' of the sleeper slab after it is built. Use only hand/plate compactors. Use only hand/plate compactors with a contact pressure that does not exceed 10 psi. [Use on all projects with a sleeper slab.] (3-17-2014)

8.05 (continued)

Z. Design headwalls to develop an ultimate moment capacity (about the horizontal axis) to resist a horizontal load of 24 k (kips) distributed over 3.5 feet applied 32 inches above top of pavement, and to develop an ultimate moment capacity (about the vertical axis) of 16.7 kft (kip feet), per foot of headwall height. Design headwall connection to deck and/or other precast units to resist these loads. Space blockouts for thrie beam guardrail at a distance of 10'-7¾" or less, center to center, along headwall. [Use when thrie beam guardrail is attached to the culvert headwalls and/or return walls. Use with Standard Plan B-23-Series.] (5-27-2014)

AA. Contact the Region Soils Engineer to perform a footing check at least 48 hours prior to excavating to the bottom of the excavation. [Use this note for spread footings and box culverts]. (4-19-2021)

BB. Contact the Region Soils Engineer to witness the Design Builder's Geotechnical Engineer perform a footing check at least 48 hours prior to excavating to the bottom of excavation. [Use this note for spread footings and box culverts on Design-Build projects only]. (4-19-2021)

CC. Install sheet piling using either an impact hammer or a variable moment driver/extractor operated to minimize vibrations. Do not use vibratory hammers that are not variable moment. [Use this note at the direction of the Geotechnical Engineer when there is concerns regarding potential vibration and/or settlement issues. For sensitive structures, alternate non-vibratory means should be considered instead of sheet piling.] (4-19-2021)

8.06.05

Pile Notes

A. Drive all piles to a nominal pile driving resistance not less than _____ kips. Determine nominal pile driving resistance (R_{ndr}) using (the FHWA Modified Gates Dynamic Formula) (dynamic test with signal matching (P.D.A. testing)) (static load tests). [Provided by MDOT Geotechnical Services Section or Geotechnical consultant. See section 7.03.09 for values and criteria. Use for **LRFD** projects only.] (8-20-2009)

B. [Load Factor Design (LFD)]
Drive all piles to a minimum bearing capacity of ____ tons. [Use for Load Factor Design (LFD) projects]

C. [Load Factor Design (LFD)]
Do not use the pile driving formulas in the Standard Specifications to determine battered pile capacity. Drive battered piles to the elevation established for vertical piles. [Use on Load Factor Design (LFD) projects when piles are driven to a 2.5V:1H batter or flatter.]

D. Use pile shells with a minimum of (0.500") (0.375")(0.312) nominal wall thickness, (16")(14")(12") O.D. [Use with C.I.P. concrete piles.] (5-24-2021)

E. The estimated pile length is based on the static analysis. (8-20-2009)

F. Drive batter piles for Abutment(s) ___ to a 3V:1H (2.5V :1H) batter angle.
(9-18-1998)

G. Use (HP 10X42) (HP 10X57) (HP 12X53) (HP 12X74) (HP 12X84) (HP 14X73) (HP 14X89) Steel piles. (11-28-2011)

H. Drive piles to such accuracy that the ends of the piles to be embedded in the concrete are within 3" of the location shown on the plans. [Use for pile bents and integral abutments with one row of piles.] (4-19-2021)

8.06.05 (continued)

I. Drive piles in a sequence that begins with the center of the pile group and proceeds outward in both directions or from one side of the pile group to the other side. The contractor may request Engineer approval to sequence the pile driving from the center of the pile group outward in a clockwise or counterclockwise pattern if four or more rows of piles exist. [Use for pipe piles to alleviate soil pressure from driven piles. A pile driving sequence will minimize detrimental effects of heave and lateral displacement of the ground as well as the influence the new construction has on adjacent structures.] (8-20-2009)

J. The estimated loss of nominal pile resistance due to scour after driving is _____ kips. [For information only. Use for **LRFD** projects only.] (8-20-2009)

K. The estimated factored downdrag after pile driving is _____ kips. [For information only. **LRFD** projects only.] (8-20-2009)

L. The factored pile resistance available to resist all factored loads (including the estimated factored downdrag) is equal to (50) (65) percent of nominal pile driving resistance (that is reduced by the loss due to scour). [For information only. Add downdrag and scour when appropriate. See section 7.03.09 for values and criteria. Use for **LRFD** projects only.]
(11-28-2011)

M. Steel piles used for pile bents are considered main members and all welding must be according to AASHTO/AWS D1.5 Bridge Welding Code, as modified by the current Special Provision for Structural Steel and Aluminum Construction. [Use only when piles project above surface and function as a true pile bent. Do not use for integral abutment piles.] (4-19-2021)

8.07.03

Prestressed Concrete I-Beam, Bulb-Tee Beam and Box Beam Notes

A. The contractor is responsible for accurately locating the rod connection between box beams. [Use when widening box beam structures.]

B. Use 0.6" nominal diameter prestressing strand meeting the requirements of AASHTO M203 (ASTM A416), Grade 270, low relaxation strand. (4-19-2021)

C Tension 0.6" dia. prestressing strands to an initial prestress of 44,000 lbs. (4-19-2021)

D. Provide concrete inserts for drain casting assembly brackets according to Standard Plan B-101-Series. Cast inserts with the beams. Do not field install inserts. (9-1-1988)

E. End blocks are (required) (optional). [Use for I-Beams.] (9-1-1988)

F. Total estimated change of length of bottom flange at transfer of prestress force is ___ ".

G. The estimated beam camber at release is ____". This camber is due to prestress and dead load of the beam only and is measured in the erected position. (8-6-1992)

H. During handling and transportation, support beams ____ feet from the end. If two additional strands are draped, support beams _____ feet from the end. [Use with 70" deep beam, Michigan 1800 beam and Bulb-Tee beams.] (4-17-2017)

I. Beams in span(s) _____ may be laterally unstable. Take precautions to ensure that beams are not damaged during handling and transportation. [Use when factor of safety for lateral buckling is 1.2 or less.] (8-6-1992)

8.07.03 (continued)

J. Threading of reinforcement and installation into concrete inserts is included in the bid item ("Prest Conc I Beam, Furn, ___ inch") ("Prest Conc Box Beam, Furn, ____ inch") ("Prest Conc 1800 Beam, Furn") ("Prest Conc Bulb-Tee Beam, Furn, ___ inch by ___ inch"). (5-24-2021)

K. Remove lifting devices after beams are erected. Removal is included in the bid item ("Prest Conc I Beam, Erect, ___ inch") ("Prest Conc 1800 Beam, Furn") ("Prest Conc Box Beam, Erect, ____ inch") ("Prest Conc Bulb-Tee Beam, Erect, ___ inch by ___ inch"). (5-24-2021)

L. Fill holes cast or formed in the beam with non-shrinking grout. Included in the bid item ("Prest Conc 1800 Beam, Erect") (Prest Conc Bulb-Tee Beam, Erect, ___ inch by ___ inch"). [Use for Michigan 1800 Prestressed I-Beam and Bulb-Tee Beams.] (4-17-2017)

M. At the locations shown on these plans, coat the beams using a material selected from the Special Provision for Concrete Surface Coatings. Apply the coating in the manner specified in the Special provision for a distance of _____ feet, starting from the beam end at the joint, coating both sides and bottom of beam. (Use concrete surface coating AMS-STD-595 color number [insert number], [insert color].) [Use on Prestressed I-Beam, Michigan 1800 beam, Bulb-Tee Beams and spread box beam projects with expansion joints on the bridge. Show the locations to be coated on the erection diagram (new) or on existing General Plan of Structure sheet for existing beams.] (2-26-2018)

8.07.03 (continued)

Prestressed Concrete I-Beam, Bulb-Tee Beam and Box Beam Notes

N. Coat the entire outside and bottom of the fascia beam using a material selected from the Special Provision for Concrete Surface Coatings. Apply the coating according to the Special Provision. (Use concrete surface coating AMS-STD-595 color number [insert number], [insert color].) [Use on Prestressed I-Beam, Michigan 1800 beam, Bulb-Tee Beams and spread box beam projects where the beam ends are being coated and where coating fascia beams will not significantly affect the maintaining traffic scheme of the project.] (2-26-2018)

O. Provide Grade 60 (ksi) beam steel reinforcement, including stirrups. [Use for Prestressed I-Beams, Michigan 1800 beam, Bulb-Tee Beams and all box beams except 17" & 21" box beams.] (4-17-2017)

P. Provide Grade 60 (ksi) longitudinal beam steel reinforcement (EA bars). The design of transverse beam steel reinforcement, slab ties (epoxy coated ED bars) and stirrups (uncoated black steel D bars) is based on Grade 40 (ksi); use either Grade 40 or Grade 60 in construction of the beam. [Use for 17" & 21" box beams.] (11-24-2014)

Q. Field drilling is allowed for sign support anchors only. Location of anchors is as detailed on Traffic & Safety Sign Support Special Details. Repair any damage to the beams at the contractor's expense as approved by the Engineer. (8-20-2009)

R. Galvanize or epoxy coat items cast into the beams to facilitate bridge construction (forming, finishing, etc.). (6-17-2013)

8.07.03 (continued)

S. Use (¾") (1") diameter concrete inserts; Dayton Superior, Type B-1 Two Strut Coil Tie - (Heavy) [¾"] (Standard) [1"] or Type B18 Single Flared Coil Loop Insert; Williams Form, Type C12 Two Strut Coil Tie or Type C19 Flared Coil Loop Insert; Meadow Burke, Type CX-4 Coil Loop Insert-Flared; or Engineer approved equal. Electroplate galvanize coil inserts in accordance with ASTM B633, Service Condition 4. Cast inserts with the beams. Do not field install inserts. [Use for Prestressed I-Beams, Bulb-Tee beams and spread box beams at backwalls or concrete diaphragms.] (4-19-2021)

T. Use (¾") (1") diameter concrete inserts; Dayton Superior, F63 Flared Thin Slab Coil Insert; Williams Form, C18 Coil Wingnut Insert; Meadow Burke, CX-28 Coil Wingnut Insert ; or Engineer approved equal. Electroplate galvanize coil inserts in accordance with ASTM B633, Service Condition 4. Cast inserts with the beams. Do not field install inserts. [Use for Michigan (MI) 1800 beams at backwalls or concrete diaphragms.] (4-19-2021)

U. Use 7/8" bolt diameter concrete inserts; Dayton Superior, F42 or F64 Ferrule Loop Insert; Williams Form, F15 or F16 Ferrule Loop Insert; Meadow Burke, FX-2 or FX-5 Ferrule Insert - Loop; or Engineer approved equal. Electroplate galvanize ferrule inserts and bolts in accordance with ASTM B633, Service Condition 4. Cast inserts with the beams. Do not field install inserts. . [Use with 70" deep beam, Type III & IV beams and Bulb-Tee beams with steel diaphragms.] (4-19-2021)

V. Use 7/8" bolt diameter, 4 ½ "(4 5/8") long concrete inserts; Dayton Superior, F42 or F64 Loop Ferrule Insert; Williams Form, F15 or F16 Ferrule Loop Insert; Meadow Burke, FX-2 or FX-5 Ferrule Insert - Loop; or Engineer approved equal. Electroplate galvanize ferrule inserts and bolts in accordance with ASTM B633, Service Condition 4. Cast inserts with the beams. Do not field install inserts. [Use for Michigan 1800 beams and Type I & II beams with steel diaphragms.] (4-19-2021)

10.01.09

MSE Walls (8-20-2009)

Shop drawings and design calculations shall be reviewed for general conformance with the design specifications (including Special Provision for MSE Retaining Wall System), plan details and the following items:

A. Geometry.

B. Factored bearing pressure versus factored bearing resistance.

C. Minimum soil reinforcement length(s).

D. Conformance to the plans and specifications.

E. Corrosion protection of soil reinforcements.

F. Coping details.

G. Aesthetic details.

H. Load and resistance factors in calculations.

I. How the MSE wall supplier is dealing with obstructions.

J. Quantities.

K. Calculations use correct parameters (such as phi angle, unit weight of soil, surcharges, etc.) specified in specifications.

L. Calculations supplied for precast panel reinforcement.

M. Professional Engineer seal from MSE wall designer.

10.01.10

Precast Three Sided, Arch & Box Culverts

Shop drawings for precast culverts must be reviewed for general conformance with the design specifications and plan details.
(5-24-2021)

12.08.02

Concrete Repair - General (10-24-2001)

Embedded Galvanic Anodes for Concrete Repairs

Galvanic anodes consist of a circular cylinder (approx. 1" thick and approx. 3" diameter) shaped cementitious shell encapsulating a zinc electrolyte. The embedded galvanic anodes serve to provide localized corrosion protection to existing uncoated steel reinforcement. Often, when new concrete is placed adjacent to old concrete, corrosion in the old concrete is accelerated. This is the result of a difference in the electrolytic potential between the new and old concrete. When placed at the specified spacing along the perimeter of concrete patches or along the interface between new/existing concrete, the anodes mitigate the formation of new corrosion sites in the existing concrete.

The embedded anodes have a life expectancy of 15 to 20 years, which is dependent on anode spacing and environmental exposure. Embedded anodes must be tied to uncoated steel reinforcement for proper function.

Suggested uses for the embedded galvanic anodes are as follows:

1. Bridge deck widening, where new concrete placed next to old.

2. Deck joint replacement, where new concrete placed next to old.

3. Substructure repairs, where new concrete placed next to old.

4. Deck repairs, where greater than ten years patch service life is required.

5. Substructure widening, where new concrete placed next to old.

For items 1 thru 5, placement of anodes will follow the Standard Specifications for Construction. (1-29-2018)

12.08.03

Substructure Repairs

A. Patching

This work generally includes the sealing of cracks and patching of spalled areas.

Designers should be aware that the cost of extensive substructure patching may be more than the cost of removal and replacement of a portion of the unit. Where removal of substructure portions is feasible it should be considered. A prime example of this is removing a portion of a pier cap on a project that includes superstructure replacement. (5-1-2000)

1. Removal of concrete shall be paid for as "Hand Chipping, Other Than Deck" and includes all areas excluding the top surface of the deck and sidewalk; i.e. all substructure units, the underside of the deck, and the barriers and fascias.

2. Patching mixtures include latex modified (LM) concrete as one of the choices. Since its bonding characteristics are superior to the others, LM concrete overlay mixtures (Table 1006-2 in the Standard Specifications) should be used for substructure repair where latex is relatively available. In the North and Superior Regions, this mixture should be used only where the project already includes LM concrete for a deck overlay. Otherwise, repairs should be made with a structure patching mixture from Table 1006-1. (5-24-2021)

3. When substructure units are patched, the entire surface of the substructure unit shall be coated with "Penetrating Water Repellent Treatment" to prevent further deterioration. As an alternative, where aesthetics are important, an elastomeric concrete sealer may be used. See Section 7.03.11. (5-1-2000)